

Ternary Mixtures of 3-Methylpyridine, Water and Sodium Bromide Studied by Adiabatic Scanning Calorimetry

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We have investigated the critical phase-separation line of the system 3-methylpyridine + water + NaBr as a function of the salt concentration by adiabatic scanning calorimetry. Recently light scattering measurements showed a crossover from Ising-like asymptotic critical behavior at low salt concentrations to a complete mean-field tricritical behavior at a concentration of about 17 % mass fraction of NaBr [1,2]. They also suggested the formation of a microheterogenous phase due to clustering of molecules and ions. We tried to verify by a calorimetric method suitable to detect very precisely phase transitions, the existence of this phase and to describe quantitatively the crossover from Ising to mean-field tricritical behavior. Our experiments show no extra specific heat anomaly that could be associated with the formation of a microheterogenous phase. Combining enthalpy and specific heat data, we find no evidence that the critical exponent alpha does show the predicted crossover from 0.11 (Ising) to 0.5 (tricritical point). This conclusion is in agreement with measurements of the viscosity in the same system that were carried out very recently and do not show any evidence for a crossover [3]. The effective critical exponent alpha which can be deduced from our specific heat capacity runs does not change much as a function of NaBr concentration, but is, however, substantially lower than the Ising value. A possible explanation for these lower values could be partial Fisher renormalization [4].

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